BUREAU OF
Entomology and Plant Quarantine
RECEIVED
DEC 20 1950
FOREST INSECT LABORATORY,
PORTLAND OREGON

Ref. #62

Indexed

543.1
342.123

NIC
SW
CD
KHW
WRC
RLF

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH ADMINISTRATION
BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

Project | Date Dec. 18, 1950 | Author Archie L. Gibson

SUBJECT—

TITLE

EXPERIMENTS TO DETERMINE THE EFFECTIVENESS OF PENETRATING SPRAYS ON MOUNTAIN PINE BEETLE INFESTED WESTERN WHITE PINE WINDFALLS.

1950

Forest Insect Laboratory

Coeur d'Alene, Idaho

INDEX NO.—

U. S. GOVERNMENT PRINTING OFFICE 16—47272-1

Experiments to Determine the Effectiveness of Penetrating Sprays on Mountain Pine Beetle Infested Western White Pine Windfalls. 1950

By

Archie L. Gibson

During the winter of 1948-49 and again in 1949-50, standing timber suffered heavy losses from windthrow and windbreak in the Inland Empire. Such material provides unusually favorable conditions for bark beetle attack and development. Much western white pine as well as other timber species were windthrown or otherwise damaged. The immensity of the problem of attempting control of bark beetles on such a tremendous and widely scattered volume of host material made it imperative that a shortcut method of treatment be developed, if possible, to meet the conditions involved. It was decided to test penetrating sprays on white pine windfalls infested with the mountain pine beetle, treating the trees "as is". Such a method would involve little or no labor to prepare the tree for treatment and consequently lower the cost.

Material to be selected for the tests would include that attacked in 1949, some attacked in early 1950, and still others being attacked at the time of treatment in 1950. Any differences in spray effectiveness in relation to age of attack could thus be measured.

On July 21 and 22 of 1950, windthrown western white pine logs were treated with penetrating sprays. Thirteen logs were treated with a mixture of one part of orthodichlorobenzene to six parts of Diesel oil. The treated material was from trees windthrown during 1948-49 and attacked during the summer of 1949. Broods had developed to a major percentage of new adults in most cases, but some sections in contact with or near the ground or otherwise subject to cooler environment, contained only larvae and pupae. Much of the bark infested was still green and all of it contained moisture decidedly in excess of that noted on standing or recently-cut infested trees. This was undoubtedly due to the functioning of roots and their contact with soil water remaining intact when the tree was windthrown.

Although the time between treatment and examination was considered too short to give conclusive evidence of spray effectiveness, excellent results were noted by July 27. Mortality averaged close to 95 percent, survival being limited to some areas of green or moisture-saturated bark. Examinations a few weeks later revealed even higher mortality, indicating that the method is fully effective on mountain-pine-beetle-infested windfalls attacked the previous year.

TABLE I

Experimental Treatment of Mountain-pine-beetle-infested Western White Pine Windfalls with Penetrating Spray - 1950

Formula: 4 parts of Diesel oil to 1 part of orthodichloro-benzene (by volume)

Time of windthrow: Winter of 1948-49

Time of attack: Summer of 1949

Date of treatment: 7-21-50

Date examined: 7-26 & 27-50

No. of logs treated	Diameter outside of bark	Sq. Ft. of bark surface	Bark Thickness	Average Percent of Control	Brood Stages
13	15"to25"	156.5	¼" to 7/8"	95 +	Larvae, Pupae, New adult.
		Check logs			
7	14" to 23"	85.0	¼" to 7/8"	2	Larvae, Pupae, New Adult.

No significant difference was noticed in the effectiveness of 1 to 4 and 1 to 6 ratios of orthodichlorobenzene to Diesel oil. In fact the 1 to 6 spray showed greater control but this was undoubtedly due to fewer logs having green or saturated bark. Data for treatment with the latter formula is as follows:

TABLE II

Experimental Treatment of Mountain-Pine-beetle-infested Western White Pine Windfalls with Penetrating Spray - 1950

Formula: 6 parts of Diesel oil to 1 part of orthodichloro-benzene (by volume)

Time of windthrow: Winter of 1948-49

Time of attack: Summer of 1949

Date of treatment: 7-22-50

Date examined: 7-26 &27-50

No. of logs treated	Diameter outside of bark	Sq. Ft. of bark surface	Bark Thickness	Average Percent of control	Brood Stages
16	13" to 19"	229.7	¼" to 5/8"	99	Larvae, Pupae, New Adult
		Check logs			
7	14" to 23"	85.0	¼" to 7/8"	2	Larvae, Pupae, New Adult

By the time the logs in these first two tests had been treated it was found that treating windfalls "as is" could seldom be done with facility without some "swamping" of limbs and brush. Although physically possible to treat the windfalls without this preliminary "swamping", the writer is convinced from his own experience, that time is saved by doing it. Furthermore, it is believed the average laborer would be inclined to do a poor job of spraying if interfering brush and limbs are not cleared away.

In previous control with penetrating sprays it was felt necessary to use the force of gravity to insure spray penetration of the bark. This was done by spraying the upper surface of the infested log, then turning it so an unsprayed portion of the bole is uppermost, spraying that, and repeating the turning and spraying until the entire circumference has been treated. By following this procedure gravity was expected to and probably did facilitate penetration of the spray.

In treating windfalls "as is" we departed from that practice in the hopes that the penetration on sides and underside of the log might be sufficient to control the brood. These tests showed that it does work. However, it must be pointed out that this method of treating must be more closely supervised if complete control is to be obtained. It was found to be very easy to miss or too lightly treat a portion of the underside and even the sides of a windfall, where access is difficult. Furthermore, the supervision must be done at the time of spraying otherwise too lightly and adequately sprayed areas cannot be readily differentiated. Although not established by tests, the writer gained the impression that lightly sprayed areas on the underside gave higher survival than similar areas on the upper side.

Just as with previous use of spray, it should be applied until the bark surface is saturated. To assure adequate coverage of the underside, spray was applied there until it started to drip.

In applying the spray, a back-pack pressure pump of 3½ gallon capacity was used with one 30-inch extension on the distant end of the hose. The extension terminated in a universal joint to which the spray nozzle was attached. Hand adjustment of this universal joint permitted application of the cone-chaped spray at any angle.

It was found that an average of 50 to 55 square feet of bark surface could be covered per gallon of spray. However, it is hardly possible that as much coverage per gallon could be expected of the usual labor available on control jobs. It is unlikely that over 40 square feet of bark surface per gallon would be attained.

The thought probably occurs to readers that applying the spray to the upper surface of the log and letting it run down over the sides and bottom should prove effective. Tests with that idea in mind showed it was not feasible. Bark ridges on white pine, and ridges and flakes on lodgepole pine, cause the running off of spray before it fully covers the sides and underside of the log.

Use of gravity flow spray application would also have limitations. Attempts to use it on trees fairly high above ground, where walking the top of the log would be necessary, would place the spray applicator in too dangerous a position. With the pressure pump the underside of windfalls lying across streams and gullies could be reached from the ground either by use of a longer extension or by means of a solid stream of spray.

On July 22, 1950, logs from trees windthrown in 1949-50, attacked by the mountain pine beetle during the early summer of 1950, were treated, as well as logs from windfalls that were being attacked at the time of treatment.

Treating logs from material attacked early in the 1950 season, gave 100 percent control. This occurred with both the 1 to 6 and the 1 to 4 spray mixtures of orthodichlorobenzene and Diesel oil.

Where attacks had been quite recent, or were occurring at the time of spraying, results from the first of this group of tests were quite erratic and the control attained could not be considered satisfactory. Nearly 50 percent of the parent adults were still alive and a few eggs had hatched. Apparently, material with bark fully saturated with sap or moisture does not permit the absorption of sufficient spray to penetrate the bark and control the brood. However, the excellent results from treatment of windfalls in which the attacks had been established for at least a couple of weeks, indicated that only the material most recently attacked or being attacked cannot be expected to give excellent control when treated.

To definitely establish these conclusions, the experiment was duplicated on August 7, choosing again some logs where there had been considerable lapse between attack and treatment, and others recently attacked and in the process of being attacked. The same two formulae, 1 to 4 and 1 to 6 parts of orthodichlorobenzene and Diesel oil, were used.

Indicated results were much more encouraging than with the previous set of experiments. Logs being attacked at the time of treatment showed fewer surviving parent adults and no eggs had hatched. Check sections, showed all parent adults alive and larvae were 1/3 grown. Results of the two series of tests are given in Table III.

TABLE III

Experimental Treatment of Mountain-Pine-beetle-infested Western White Pine Windfalls with Penetrating Spray - 1950

Formula: 6 parts of Diesel oil to 1 part of orthodichloro-benzene (by volume).

Time of windthrow: Winter of 1949-50

Time of attack: About July 1-10, 1950

Dates of treatment: 7-22-50 and 8-8-50

Dates of examination: 7-27-50 and 9-2-50

No. of logs treated	Diameter outside of bark	Sq. Ft. of bark surface	Bark Thickness	Average percent of control	Brood Stages
		Treated 7-22-50			
2	15" to 17"	31.75	¼" to 1¼"	100 About ½ the parent adults alive. A few eggs had hatched	Eggs & Parent adults
		Treated 8-7-50			
5	15" to 18"	75.0	¼" to 1¼"	100 Few Parent Adults alive No eggs hatched	Eggs & Few Larvae
		CHECKS			
4	15" to 18"	80.0	¼" to 1¼"	Parent adults alive and numerous living larvae 0 - ½	

Where control is instituted in late summer or fall by the penetrating spray method of treating, it has been found that the final effect of the treatment may not be obtained until late the following spring or early summer of the next year. Consequently we believe the final measure of effectiveness of the spray on these recently attacked trees may not be definitely established until 1951.

Is the attack and infestation pattern similar on both windfalls and standing trees? The writer found the following conditions prevailed:

(1) Windfall material completely off the ground and in shade was likely to be attacked on all sides.

(2) Material completely off the ground, but in sunlight, usually had no mountain pine beetle attacks on the upper side but the rest might be completely attacked.

(3) Wherever the material was on or very close to the ground, that portion was not attacked by the mountain pine beetle. These observations refer only to material attacked subsequent to windfall. Where attack by the mountain pine beetle had occurred prior to windthrow the attack pattern would be the same as on any standing tree.

The practical value of the preceding observations is that it will not be necessary to treat the underside of windfalls where they are on the ground or so close to it that a spray nozzle could not be placed between the ground and log. Wherever the spray nozzle can be used, infestation by the mountain pine beetle can be expected.

It was also found that the ratio of infested to uninfested bark surface was likely to vary widely on different windfalls. Some were heavily infested from the base to as high as a four inch diameter top, whereas, at the other extreme only a few attacks might be found and these limited to the underside, often many feet from the base of the tree. With such a variation in infested bark surface it would be necessary to carefully examine each windfall to determine if it had been attacked and if so, the amount of infested surface.

In conclusion the following results of these tests should be emphasized:

(1) Broods of the mountain pine beetle infesting western white pine windfalls can be completely controlled by penetrating sprays wherever the successful attack of the tree has occurred more than a few weeks before treating.

(2) Where attack of windfalls has occurred in the last few weeks, or is in progress at the time of treatment, only partial control can be assured, judging from the limited tests made so far.

(3) Windfalls must, in general have some preliminary "swamping" to facilitate treating.

(4) Treatment of windfalls requires closer supervision during spraying in order that a thorough job can be assured.

(5) The underside of windfalls, which are on or very close to the ground, have not been found to be infested by the mountain pine beetle.

(6) A spray of 6 to 1 Diesel oil to orthodichlorobenzene gives effective control when properly applied to windfalls.